Frontier Developments in Mini-grids

Scaling Successful Mini-grid Programs: Experience of Bangladesh

Farzana Rahman
Unit Head (Investment), Renewable Energy
IDCOL, Bangladesh

6 December 2017
Abuja, Nigeria

Solar Mini-grids in Bangladesh

- Mini-grid in Bangladesh:
  - refers to 100kWp to 250kWp solar PV projects with diesel gen-set backup
  - located in isolated off-grid areas
  - ensures 24/7 grid quality electricity supply
  - connects 400-1000 customers (businesses, HHs)

- Implemented by: Private limited companies/NGOs
- Financed by : IDCOL
- Target : 50 projects by 2018
- Progress : 10 in operation, 15 under construction, 20 in pipeline
- Project life : 20 years
- Tariff : 38 US cents per kWh

IDCOL
TOGETHER FOR TOMORROW

An Overview of IDCOL

- A development financial institution owned by Bangladesh government
- Started operation in 1997
- Works to support the **private sector**
- Operates in **infrastructure** and **renewable energy** sectors
- Largest financier of infrastructure and RE projects in Bangladesh
- Funded by development partners like the World Bank, ADB, JICA, IDB, KfW, GIZ, USAID, DFID, GEF
- Invested approx. **USD 1,000 million** in renewables

Infrastructure

Power

Telecommunications

Port

Renewable Energy

Solar Home System

Solar Mini-grid

Solar irrigation Pump

Financing Structure and Funding Source

- Financing structure
  - Sponsor's Equity : 20%
  - Concessionary Loan (for 10 years) : 30%
  - Grant : 50%

❑ Funding Arrangement:

❑ Loan Sources:

❑ Grant Sources:

Key Features of Typical Mini-grid Project

- Located in isolated off-grid areas
- Cleared by Power Division where possibility of grid extension is remote
- Plant location is free from flood and river erosion
- Concentration of customers is high
- Possibility of day load usage
- Willingness and capability of the customers

IDCOL
TOGETHER FOR TOMORROW

Mini-grid Projects Financed by IDCOL

10 Operational Projects

15 Projects Under Construction

Mini-grid Vs. SHS

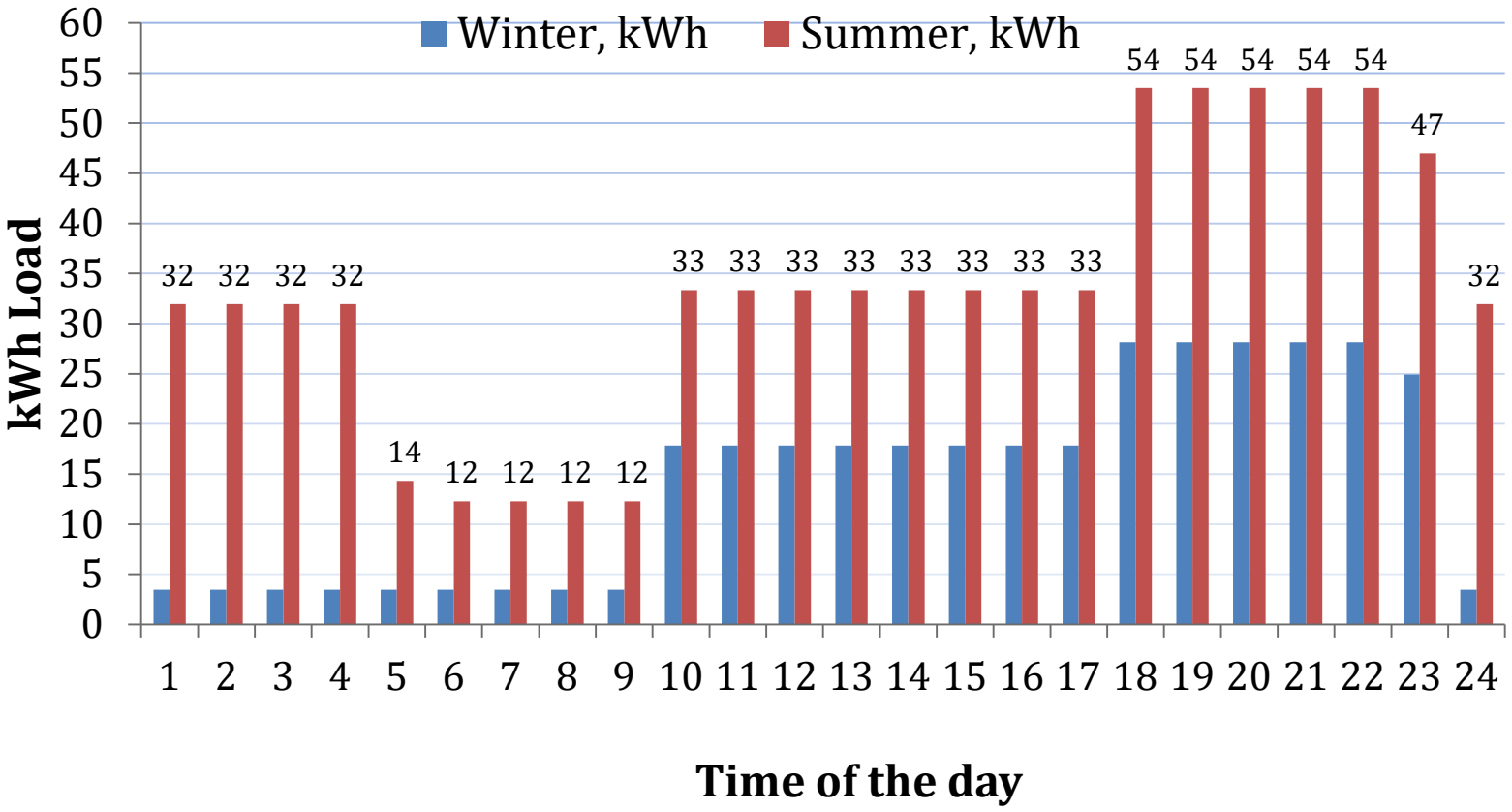
Aspects	SHS	Mini-grid
Use of higher loads i.e. ceiling fans, color TV, refrigerator etc.	Not possible in typical SHS	Possible
Operation of industrial loads	Not possible	Possible
Initial investment of the customer	High, for system purchase	Low, for one time connection fee
Maintenance requirements	Need to be done by owner	Done by plant owner
Replacement of battery by customer	Needs to be replaced after 3-5 years	Not needed. Done by plant owner after 7 years.

IDCOL
TOGETHER FOR TOMORROW

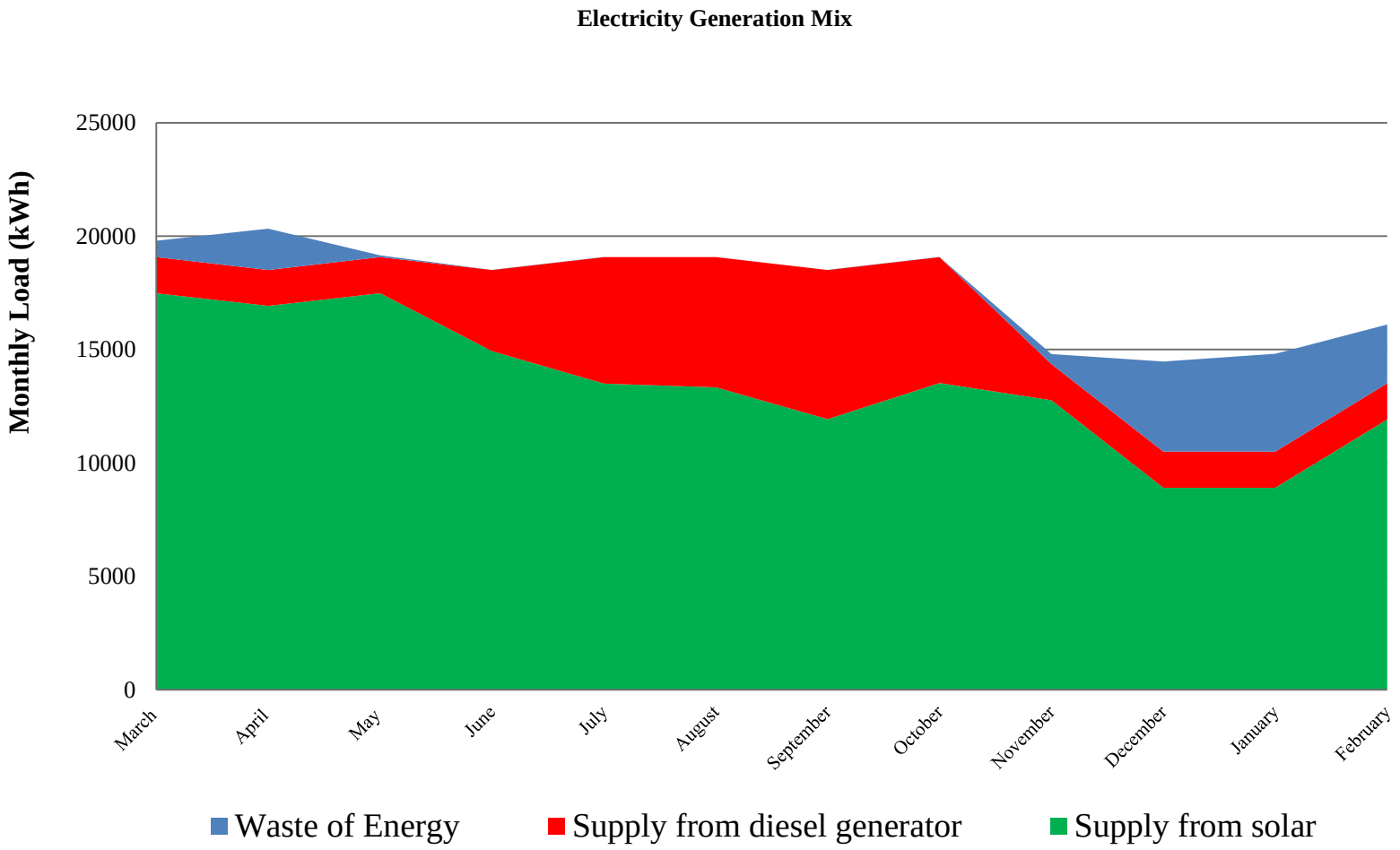
Mini-grid Vs. Grid

- Grid extension in remote river and sea islands is extremely challenging
- Grid expansion is not financially feasible due to less number of customers
- Distribution line set-up is challenging due to distance from main land to islands

Expected Daily load pattern



Expected Electricity Generation Mix



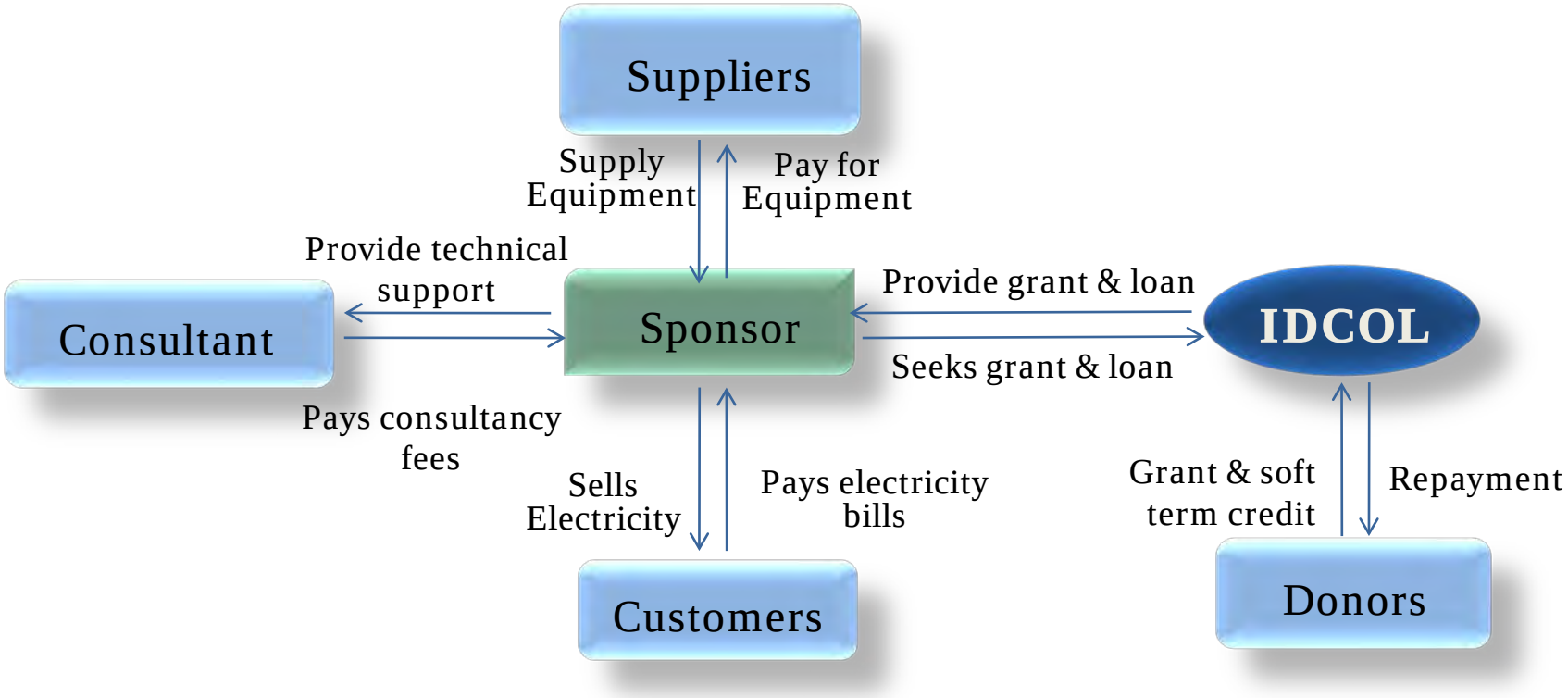
Electricity supply from solar portion is 80 - 85% of total consumption

Estimated Cost of a 250 kWp Project

Particulars	Amount in 'ooo USD	%
Land and land development	40	4%
Civil construction	130	12%
Equipment	540	48%
Solar PV module & mounting structure	*170*	*15%*
Battery & accessories	*190*	*17%*
Inverter & accessories	*150*	*13%*
Generator & accessories	*30*	*3%*
Distribution system costs	270	24%
Installation, transportation and others	140	12%
Total	**1120**	**100%**

Project cost per Wp is USD 4.5

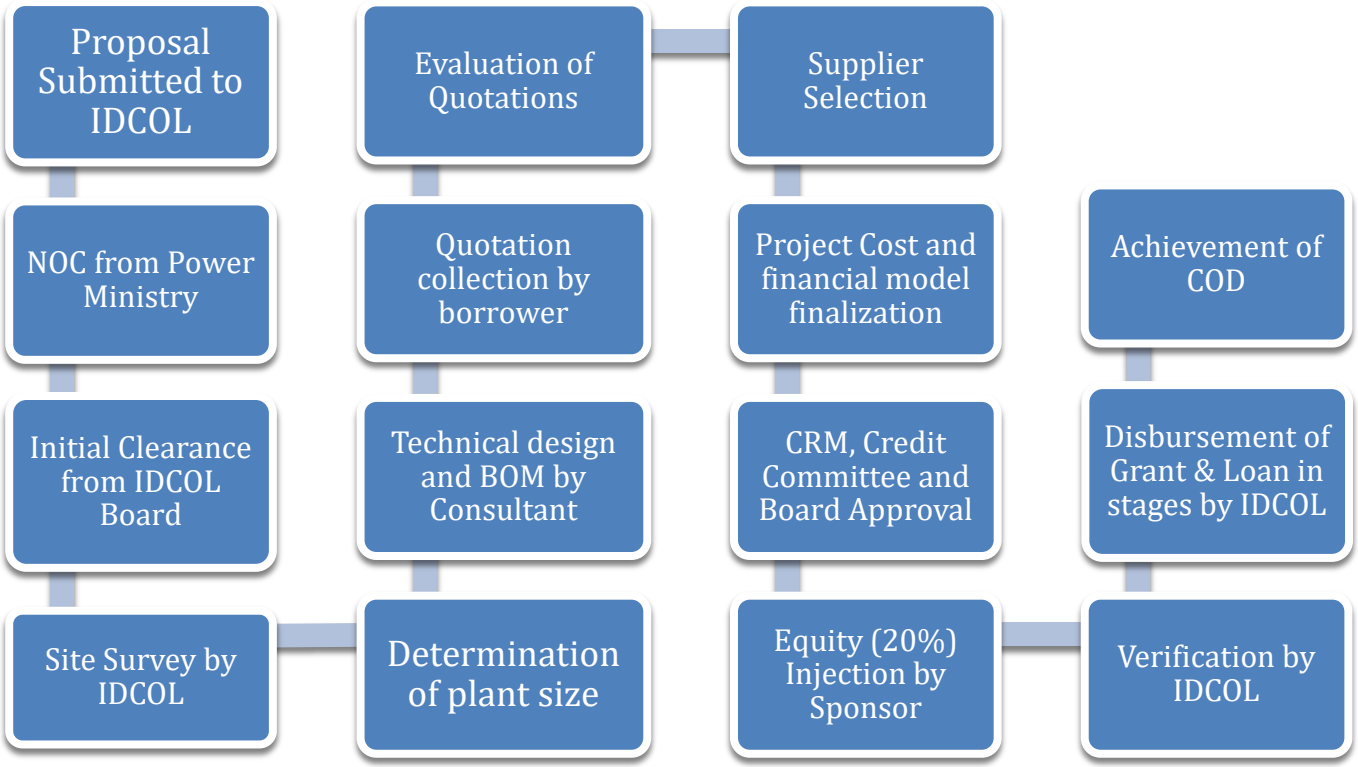
Role of Partners: At a Glance



Eligibility Criteria of Sponsor

- NGO/ limited company or of any other form as deems appropriate to IDCOL
- Capability to inject minimum equity of 20% of the project cost
- Capability to provide collateral against IDCOL loan
- In-house technical capacity for implementing and operating project
- Have a successful track-record in doing business
- Prior experience in implementing similar projects is an added advantage

Flow Chart of Approval Process



Some IDCOL financed Mini-grid Projects

PGEL 100 kWp mini-grid project

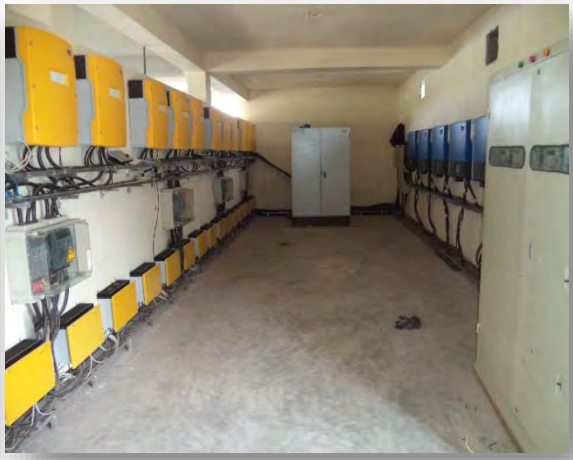
SEBL 177 kWp mini-grid project

SBL 141 kWp mini-grid project

Superstar 242 kWp mini-grid project

Inverters






Batteries

IDCOL
TOGETHER FOR TOMORROW

Distribution Lines

Customers

IDCOL
TOGETHER FOR TOMORROW

Challenges faced by Private Sector

- Absence of proven technology
- Adequate financial return from the project
- Availability of quality equipment at competitive price
- Absence of regulatory framework
- Threat of grid expansion
- Payment collection from the customers
- Absence of financing

Overcoming technological challenge

- Private sector want to get fully convinced about technology.
- First solar mini-grid project was installed in Bangladesh in 2010
- And it took 4 years for next projects to come into operation.
- Lessons learnt from the 1st project helped to improved the later projects.

Ensuring adequate financial return

- IDCOL has developed a financing model (financing structure and tariff) which ensures:
  - Minimum 14% return on equity investment
  - Payback period 7-8 years
  - Full capacity utilization during 2 years' grace period
- Market risk is minimized through detailed survey where customers' affordability/willingness are considered for sizing
- Energy efficient appliances are promoted to reduce customer payment

IDCOL
TOGETHER FOR TOMORROW

Supply of Equipment

- **Availability of quality equipment**
  - IDCOL formed a technical committee to set technical standards.
  - Took technical assistance from development partners.
  - Suppliers need to take product approval from the committee.
- **Ensuring competitive price**
  - IDCOL encouraged suppliers of its SHS program to participate.
  - Inclusion of many suppliers created competition, reduced price.
  - Local industry can supply battery at good price.

IDCOL
TOGETHER FOR TOMORROW

Establishing Regulatory Framework

- IDCOL pursued the government to set a regulatory framework for RE.
- Government adopted a guideline for solar mini-grid in 2014.
- Mini-grids up to 250 kWp do not require license to sell electricity.
- SREDA was formed in 2014 to support RE initiatives including solar mini-grids
- Department of Environment upgraded category of solar mini-grid from 'Red' in 2017 (power projects are in Red category).

Addressing Threat of Grid Expansion

- Mini-grid projects are installed only in isolated off-grid areas.
- IDCOL takes clearance from government utilities.
- Government adopted a guideline to purchase electricity ensuring 15% return if grid is extended after 5 years of mini-grid installation.
- Recently, government agreed, in principle, to purchase electricity even if grid is extended within 5 years.

IDCOL
TOGETHER FOR TOMORROW

Other Issues

- **Payment collection from the customers**
  - Prepaid meter has been made mandatory for solar mini-grid.
- **Ensuring necessary financing**
  - Arranging finance is not a major challenge if implementation structure is properly designed.
  - Development partners provide necessary financing support if projects are technically and financially feasible.

Solar Mini-grid Impact

- 19 sponsors are implementing 25 mini-grids creating local level jobs both directly and indirectly
- Electricity of solar mini-grid has paved the path for new commercial ventures i.e. auto rickshaw, auto rickshaw charging station, rice mill, saw mill, flour mill, oil mill, cold storage, ice factory, irrigation pumps, computer centers
- Developed communication through introduction of new modes of transportation and telecommunication i.e. e-mail, agent banking
- Mini-grids use local IDCOL batteries which has improved the capacity of local battery manufacturers
- IDCOL has introduced a rigorous enlistment process and a pool of suppliers for ensuring quality work
- Solar mini-grids promote the use of energy efficient appliances
- IDCOL provides capacity building trainings to beneficiaries which increase their knowledge base

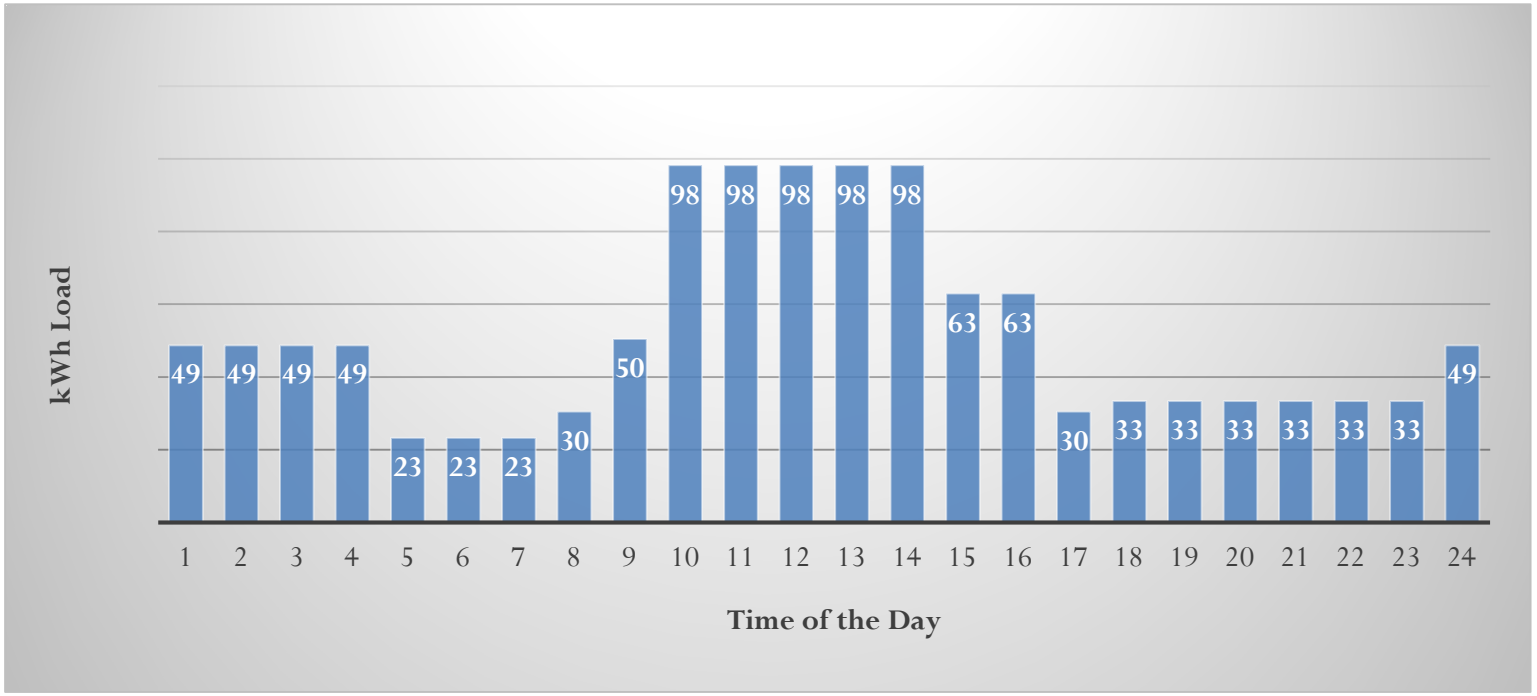
IDCOL
TOGETHER FOR TOMORROW

Success Factors

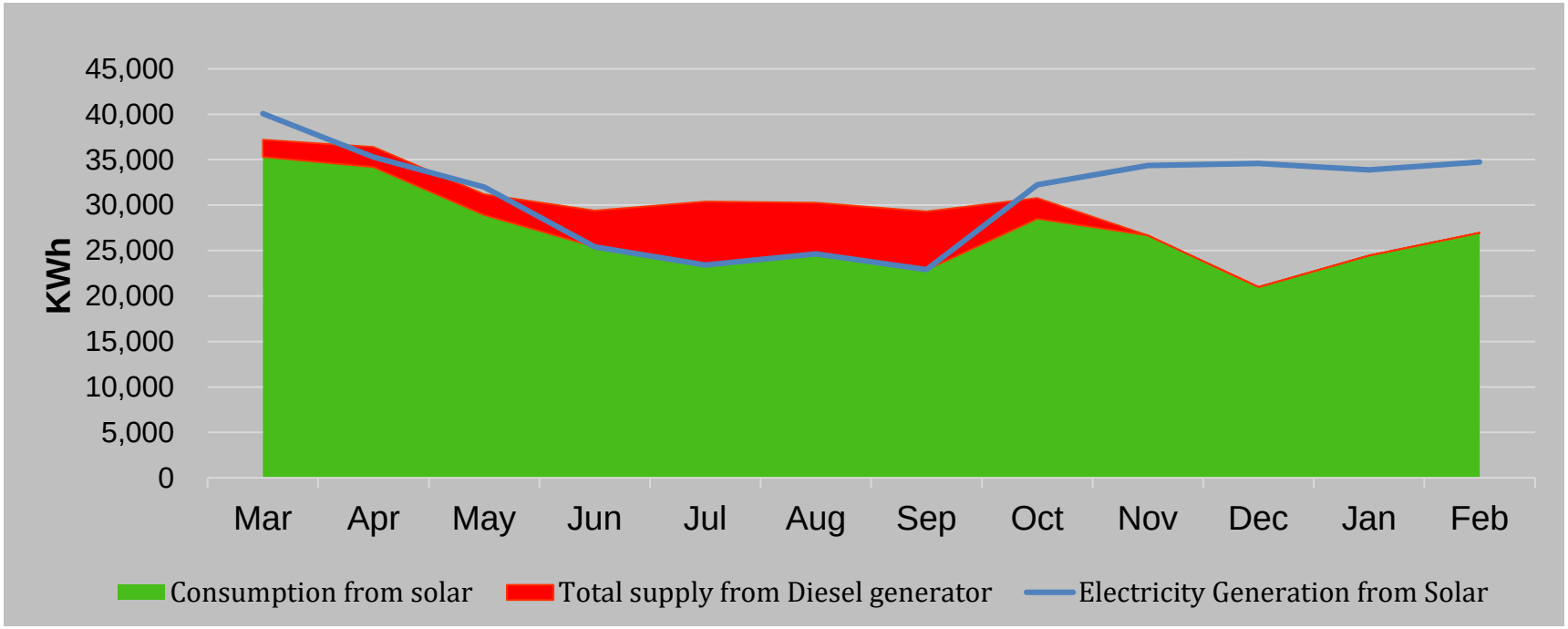
THANK YOU

IDCOL
TOGETHER FOR TOMORROW

Expected Daily load pattern



Expected Electricity Generation Mix



Electricity supply from diesel generator is less than 10% of total consumption